CAST-IRON BRIDGES.

On the York and Midland Railway, there is a cast-iron bridge of 60 feet span, erected for the convenience of the navigation of the River Wharne, which was constructed in the place of a brick arch, and without delaying for a single day the traffic of the railway. The *Railway Chronicle* of September the 27th, gives a description of this bridge with illustrations. We extract the following:—

"This bridge was constructed on the designs of Mr. Cabry, the engineer of the line, and the circumstances in which it was formed serve both to shew the peculiar good properties and the extensive capabilities of this kind of bridge, as well as the dexterity and skill with which they were here employed. The former bridge had a central brick arch, an elliptical one, over the river Wharne. This impeded the navigation, and those old and inveterate enemies of the railways, the canal and navigation proprietors and carriers, made the most of the impediment of this arch to their navigation, of which, however, there happened to be wretchedly little to be impeded. However, the bridge must be improved, and full clear head room to a certain height of water obtained all across. To conform to these conditions was rather difficult, under the peculiar circumstances of the case, especially as the railway was opened to enormous working traffic. In this difficulty Mr. Cabry tried his talent; he opened up the road-way on the back of the arch, he inserted masonry to carry the bearings of the large cast-iron girders, he had these girders erected in their place, without disturbing all this while, either the arch below the railway or the rails themselves. The girders are wholly clear of the lines of rail. The girders, too, are wholly above the line, while the arch was entirely below. The rails across the arch were carried on longitudinal bearings; below these were passed from girder to girder, timber baulks, laid close, so as to form a continuous platform. The railway was thus carried at one and the same time by two bridges, the old brick arch wholly below the rails, and the new cast-iron bridge wholly below. One fine morning, however, Mr. Cabry chose to knock away the under one, and there was the clear open navigation, and the railway suspended in the air, as now is and will be for many a day to come. To force up the piers was an easy matter, and give them their present handsome aspect. And all this done without a day's stoppage of either the navigation below or the line above! These are some of the little satisfactory passages in the life of a sound-headed, right-hearted engineer, which make his life so pleasant a thing to look back upon. A hardworking life is, after all, far the happiest—perhaps, also, the best; for, as Carlyle says, with one of his alliterations, *work* is only another form of *worship*; or, as old Boston has it, because the devil is always busily engaged in providing jobs for those who are idle.

The revolution which the introduction of cast-iron has produced and is still extending throughout many branches of practical building, is now every where conspicuous in our cities and our public works. It is extending itself in railways perhaps more rapidly than any where else. At first cast-iron was received into railways suspiciously and slowly. This was to be expected. Cast-iron, as a material for rails, was rejected, on account of its great liability to fracture, and it was not to be expected that it would soon recover this disgrace and be admitted to the much more responsible position of supporting a bridge and carrying the weight of a whole train over a wide span, when it had just been pronounced unfit even for a small one.

Gradually, however, cast-iron, on account of its great convenience, and, in many cases, its economy, overcame some of the prejudices against it. The best form for beams of cast-iron came to be more studied and better understood. It was found to possess the great advantage of being readily obtained of any required form,—which is indeed always the advantage of a flowing over a merely malleable material. From this circumstance it could be introduced in all those difficult cases where, in low embankments, the utmost head room is required. It was found also to present great advantages where the piers did not possess foundations capable of carrying heavy arches over a wide span. All these inducements proved too strong for the antipathy of engineers for a material hitherto regarded as treacherous, and cast-iron has consequently received such attention as to have matured its perfections and provided remedies for its imperfections, to such an extent that its employment is becoming general and extremely to be commended, both for economy, convenience, and security.

Precautions, as we have just said, must be taken against the possibility of its treachery. It is a good, strong, manageable servant, but occasionally given to tricks. These, however, must be guarded against; various modes of doing this have been devised. Among these, is the system of simple *malleable iron trussing*, which was, we think, originally invented by Mr. Robert Stephenson, illustrated in the bridge in question. This trussing not only contributes to the strength of the materials while they remain sound, but in any case of fracture would serve to prevent the catastrophe of an instant breakdown in case of a flaw in the cast-iron girder.

To accomplish the change both lines at a certain point were diverted into one, and the stonework to receive the girders proceeded with, which being done, the two girders, after being firmly bolted, were placed on trucks and run along to the spot, then lowered to their places by means of jack screws, and there firmly bedded in lead, a quarter of an inch thick. A platform of Memel timber, nine inches thick, was then placed so as to rest on the flanges at bottom of beams; on this the rails were laid, and the traffic of the line again diverted to this side during the operations on the other. The brick arch was then removed, without any cutting, by suspending a scaffold (composed of two half-balks of timber) to the platform; and after taking the two first courses off the top, operations were commenced at the side, removing the whole without losing more than three yards of brickwork.

The girders were cast in three lengths, and connected by six 1½-inch bolts, passing through strong flanges accurately fitted to one another. In addition to the bolts were strong cast-iron plates, dovetailed and made to slip easily over snugs left on the bottom, which were then tightened up by the introduction of a steel key. On each side of the girder were placed strong wrought-iron stays, 6 inches deep and 1¼ inch thick, in three lengths of links, each 21 feet long. The eyes of these links were made sufficiently large to fit a pin or bolt of 4¼ inches diameter exactly. This pin passes through the girder by means of a hole large enough to allow play on all sides. To this pin and outside of links are attached strong iron straps passing downwards through the dovetailed plate, and there, by means of nuts and screws, adjusted to the required tension. The web of girder is 2¼ inches thick throughout, varying in depth from 4 feet 8 inches to 3 feet 3 inches, as circumstances require. Along the bottom and on each side are two flanges, 2¼ inches thick, increasing in breadth from 7 inches at ends to 11 inches at centre. A moulding 8 inches broad and 3 inches deep runs along the top from end to end; and this, besides adding to the stability of the girder, relieves the eye from what would otherwise appear heavy and clumsy. The whole span of bridge, clear of supports, is 60 feet, thus leaving the extreme ends 5 feet for a bearing on the masonry. The flange of bottom at this part widens out 2 feet 6 inches, and is bedded, as previously mentioned, on lead. They were placed 2 feet apart at centre, the two outside ones 11 feet 6 inches from them. We subjoin a table of the weight of material used in its erection, with the estimated cost attached to each article:—

	£	s.	d.
Weight of cast-iron girders, 77 tons 6 cwt. 2 qrs. at 6*l*. per ton	£463	19	0
" Wrought-iron work, 12 tons 12 cwt. 2 qrs. 15 lb., at 21s. per cwt.	265	5	4
" Steel keys, 1 cwt. 1 qr. 2 lb., at 1s. per lb. ..	7	2	0
Timber for platform	150	0	0
Brickwork in facing abutments ..	35	0	0
Labour, &c.	80	0	0
Total cost	£1,000	0	0

Railway Joke.—Some wag has been at the expense of inserting a long advertisement in the *Railway Chronicle* of the Great National Direct Independent Land's End and John O'Groats Atmospheric Railway, with Steam Ferries to the Scilly Isles and Coasting Docks at both Extremities. It is drawn up with such an air of seriousness, and is so much *less* absurd than many of the prospectuses now before the public, that shares in it will probably be written for. The capital asked for is nine and a half millions, and the projector promises that though the line will pass some of the largest, most populous, and interesting towns in England, it shall stop at none, but go on at once to the sea. Bankers—all the banks of England and Scotland, and the towns passed by the line. Solicitors, Bull, Scott, and Co., Lincoln's-inn. Brokers, all the Stock Exchange. Secretary, John Smith, junior, Esq.!

Improvement in the Moulds for Casting Iron Tubes or Pipes.—M. C. Harrison, an intelligent French engineer, has proposed an improvement in the mould in sands in the casting of iron tubes or other cylindrical bodies, by means of which the mould or model can serve for several others, at the saving of considerable trouble, and produce an article superior in quality to that in which the mould is destroyed each time that it is used. His plan is this—he establishes two shells, hollowed in a cast, of dimensions proportionate to the pipes or other bodies moulded in the iron casting; these shells are pierced in various parts, with a certain number of holes distributed on the surface and bearing from the interior to the outside, points or asperities scarcely evident. The calibre, or bore, which is nothing more than the profile of the exterior surface of the tube, is provided at both extremities with axes, whilst the interior of the mould is polished with sand in the shells, rolling upon gutters at their extremities. When the model is to be made in sand, the humid matter is to be laid as usual, and the sand to be beat in the interior of the shells; with the aid of the calibre, which is placed for that purpose on the shells, a pure and correct form is given to the mould internally; when the interior of the mould is thus finished with proper care, and when the core is removed, it is placed in an oven, and when perfectly dry the borders of the shells are to be cleaned, so that they may join exactly; a kernel well dried is then placed at the interior of the lower shell, and the two shells fastened together with iron pins or small keys. Immediately the tube to be moulded has been raised up, the two shells must be examined, and if any of the parts have been damaged, they must be repaired; they are then smoked, and again dried; the kernel and the strainer are to be replaced, and so, one after another, the mould remains in a good state.

The Direct West-End and Croydon Railway.—The professed object of this scheme is to lessen the inconvenience to which parties are now subjected in proceeding from the west end of the metropolis to Croydon, or the more distant places on the South-Eastern and London and Brighton Railways, as well as the several sea-ports and packet-stations on the coasts of Kent and Sussex. The Viscount Ingestre takes the lead in the list of the Provisional Committee, and is supported by several of the London Aldermen, a few members of Parliament, and a great number of chairmen and directors of other and similar projects. Sir John Macneil is the consulting engineer. The proposed capital is 800,000*l*. to be divided into 40,000 shares, of 20*l*. each.

Tring, Cambridge, and Newmarket Railway.—The towns comprised in and proposed to be benefited by this line are Tring, Dunstable, Luton, Hitchin, Baldock, Royston, Cambridge, Newmarket, Bury, Ipswich, Norwich, and Ely; in short, the entire circle of the western counties bounded by the Thames southward and the Wash to the north. The capital required is 600,000*l*., which it is proposed to raise in 24,000 shares of 25*l*. each, with a deposit of 2*l*. 12s. 6d. Lord Edward Chichester and Viscount Mandeville head the list of the provisional committee, which contains also several chairmen, vice-chairmen, and directors of existing lines. Mr. Oliver Byrne is the acting engineer, and Mr. Francis E. Fowler is the architect and surveyor.